

Application No.: 10/647,247
Attorney Docket No.: 031029
Amendment under 37 CFR §1.114

REMARKS

Claims 1, 3 and 5-19 are pending in the present application. Claim 1 is herein amended.

Notice of References Cited - Form PTO 892

Applicants note that the Takahashi (U.S. Patent No. 6,537,719) was not included in the Notice of References Cited. Applicants request the addition of Takahashi to the Notice of References Cited - Form PTO 892.

Claim Rejections - 35 U.S.C. §§ 102 and 103

Claims 1, 3, 5, 6, 8-15, 18 and 19 were rejected under 35 U.S.C. § 102(b) as being anticipated by **Kanda** (EP 1152036); claim 7 was rejected under 35 U.S.C. § 103(a) as being unpatentable over **Kanda** in view of **Suzuki** (US 6,043,145); and claims 16 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Kanda** in view of **Takahashi** (US 6,537,719) and **Tanaka** (US 6,555,617).

Favorable reconsideration is requested.

Kanda discloses applying a water soluble resin composition onto a resist pattern, heating to crosslink by acid supplied from the resist, and development to remove the non-crosslinked water soluble resin coating layer. Kanda discloses that the resist pattern in Kanda is thickened with the crosslinked resin.

By contrast, the present invention provides a method of manufacturing a semiconductor device capable of highly detailed patterning using a resist pattern having smoothed wall surfaces in which the shape and size of the resist pattern is kept as close to the same as possible by adjusting an application thickness of a resist pattern smoothing material and heating temperature.

Application No.: 10/647,247
Attorney Docket No.: 031029
Amendment under 37 CFR §1.114

(See specification, pages 28-34, Examples 1-3.) Claim 1 has been amended to recite a thickness range for the resist pattern smoothing material and a heating temperature range.

Applicants respectfully submit that Kanda does not teach or suggest:

wherein the predetermined opening dimension D (nm) of the resist pattern, and an average opening dimension D_{av} (nm) of the smoothed resist pattern whose wall surfaces have been smoothed satisfy the relation expressed by:

$$D_{av} \text{ (nm)} \geq D \text{ (nm)} \times (90/100)$$

as recited in claim 1.

As stated above, Kanda discloses that the resist pattern in Kanda is thickened with the crosslinked resin. Specifically, Kanda states:

[i]n particular, the present invention [Kanda] relates to a water-soluble resin composition which is coated on resist patterns formed and then ***crosslinked for thickening the resist patterns*** to fine effectively trench patterns or hole patterns and ***reduce the size of a space*** in the resist patterns.

(Kanda, Paragraph 1; *see also*, Paragraph 22.) In addition, Kanda evaluates the degrees of reduction of size due to crosslinking of the water-soluble resin coating layer in the Examples. (Kanda, page 6, line 50; Paragraphs 36 and 37.) The degree of reduction in size is a percentage calculated by dividing the difference between the size of the space before formation of the crosslinked insoluble layer and after the formation of the crosslinked insoluble layer by the size before the formation of the crosslinked insoluble layer (multiplied by 100). (Kanda, page 7, lines 9-15.)

Application No.: 10/647,247
Attorney Docket No.: 031029
Amendment under 37 CFR §1.114

According to the results in Table 1 of Kanda, (page 7), the degree of reduction in size of the space of the resist patterns for the water-soluble resin composition of the invention of Kanda was 43.6% and 51%, respectively for different resist patterns. In the comparative examples of Kanda the reduction of the size of the space in the resist patterns was at least 37%. This further supports that Kanda's invention emphasizes thickening the resist and reducing the space in the resist pattern with the resin coating layer.

By contrast, claim 1 of the present application recites that the average opening dimension (D_{av}) of the smoothed resist pattern, *i.e.*, the average opening dimension after applying the smoothing material, is at least 90% of the predetermined opening dimension (D) of the resist pattern, *i.e.*, the opening dimension before applying the smoothing material. In other words, this expression in claim 1 states that at most, the average opening dimension is reduced by 10%. This limitation of claim 1 emphasizes that the wall surface of the resist pattern is smoothed and the roughness is reduced without causing a big change in the shape and size of the resist patterns.

Kanda discloses reducing the size of resist patterns between 37% and 51%, (Kanda, Table 1), and a preference for a larger reduction in the size of resist patterns (compare "Examples" and "Comparative Examples"). Claim 1 of the present invention recites reducing the size of the resist pattern by at most 10% expressed by " $D_{av} \text{ (nm)} \geq D \text{ (nm)} \times (90/100)$."

Therefore, Kanda does not teach or suggest all the elements as recited in claim 1.

Application No.: 10/647,247
Attorney Docket No.: 031029
Amendment under 37 CFR §1.114

Double-Patenting Rejection

Claims 1-19 were provisionally rejected under judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-21 of copending Application No. 10/290,493.

Applicants will address the provisional double patenting rejection once all other rejections have been withdrawn.

For at least the foregoing reasons claim 1 is patentable over the cited references, and claims 3 and 5-19 are patentable by virtue of their dependence from claim 1. Accordingly, withdrawal of the rejection of claims 1, 3 and 5-19 is hereby solicited.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

Application No.: 10/647,247
Attorney Docket No.: 031029
Amendment under 37 CFR §1.114

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP



Andrew G. Melick
Attorney for Applicants
Registration No. 56,868
Telephone: (202) 822-1100
Facsimile: (202) 822-1111

AGM/adp